CHAPTER X

POTENTIAL DAMAGE TO WILDLIFE, VEGETATION, AGRICULTURE, AND PHYSICAL STRUCTURES (40 CFR 264.94(b)(1) (viii) and (2) (ix))

In addition to risks to human health, environmental risks must be addressed in an ACL demonstration. Unless an ACL demonstration is based on the point of exposure at the point of compliance, and the nearest likely receptor is human, risks to animals, plants, and structures resulting from exposure to the hazardous constituents must be considered. This environmental risk assessment involves an exposure assessment and an effects assessment. This chapter delineates the information needed to perform the assessments of risks other than those to human health.

The initial step in assessing possible environmental impacts is to determine the probable exposure pathways for hazardous constituents to reach environmental receptors. For ACL purposes, the receptors of concern include wildlife and vegetation in aquatic and terrestial environments; agricultural crops, products, and lands; and physical structures. The exposure assessment involves examining the extent of the hazardous contaminant plume, and the location of receptors and environments of concern. The exposure assessment will result in delineation of likely exposure pathways. Information submitted to fulfill requirements discussed in previous chapters should be adequate to determine probable surface water and terrestrial exposure pathways. The permit applicant should examine the data requirements of Chapters VI and VII before proceeding with this chapter. The data for assessing the effects of exposure of physical structures and agricultural crops, lands, and products to the hazardous constituents are discussed in subsequent sections of this chapter.

The permit applicant must examine the potential impacts to all the receptors discussed above if exposure to hazardous constituents is likely to occur. Otherwise, the permit applicant should discuss specific data that supports no probable exposure as well as justify why the potential impacts assessment is unnecessary.

Generally, data on chronic toxicity levels of the hazardous constituents are sufficient to characterize potential environmental impacts. However, chronic environmental toxicity data may not be available for many waste constituents likely to be the subject of ACL requests. In the absence of environmental toxicity data, ACL applicants may be able to argue that a contaminant will have no adverse environmental effects. This argument could be based upon considerations of exposure levels and the toxicities of similar chemical compounds. If environmental receptors are actually being exposed to ACL constituents above chronic toxicity levels, or above background levels if no chronic toxicity levels are established, then field assessments of the impacts can be performed to support the proposed ACLs. The types of field studies that should be carried out are discussed in more detail in the following sections.

Terrestrial Impact Assessment

The quantification of adverse terrestrial environmental effects is difficult. However, examination of several environmental factors will provide an estimate of potential impacts to the environment due to exposure to contaminated ground water.

Potential impacts to terrestrial wildlife and vegetation can be assessed by examining exposure and environmental toxicity factors. The exposure assessment involves determining whether the contaminated ground water at a facility has the potential to impact any terrestrial environment. The specific data necessary to assess the exposure are discussed in Chapters II, III, and IV. If there is a likely pathway for wildlife and vegetation to become exposed to contaminants, then environmental toxicity factors should be examined. ACL applicants probably will not need to address terrestrial environmental impacts in detail when there are no direct exposure routes between terrestrial systems and ground water. In these cases, or when the POE is set at the POC, the applicant can omit this section and move on to the endangered species section of this chapter.

The toxicity and bioaccumulation of hazardous constituents by terrestrial flora and fauna should be examined if exposure is likely. Terrestrial species can be exposed to toxicants either directly through assimilation of or contact with contaminated ground water, or indirectly through food web interactions. Toxicants

can accumulate in exposed biota and increase to levels that are lethal or have chronic effects. The permit applicant should perform a comprehensive literature search for toxicity and bioaccumulation values for the ACL constituents and their degradation products. The information should be summarized in a table that includes information on the toxicants, the test species, the specific effects, the effect levels, the bioaccumulation potential, and the reference. The permit applicant can base the potential terrestrial toxicity assessment on the most toxic constituent within a group of constituents if appropriate groupings of constituents exist for a facility. If literature information is sparse or non-existent, then a more thorough analysis of potential environmental impacts may be necessary. This analysis could be based on consideration of exposure levels and the toxicities of similar chemical compounds. Bioassays could also be used to support the proposed ACLs; however, techniques for performing bioassays on terrestrial ecosystems are not an exact science, and they involve considerable time and expense to carry out. If the permit applicant plans to perform bioassays, he/she should consult U.S. EPA (1984d) for more discussions on the use of bioassays to characterize chemical waste sites.

If terrestrial environments are presently being exposed to contaminants above chronic toxicity levels, or above background levels for constituents without established chronic toxicity levels, then field studies can be used to support the proposed ACLs. The permit applicant should examine the dominant terrestrial habitats in the vicinity of the facility. Evidence of any stressed vegetation should be documented and can be supported with aerial infrared photography or ground photography and vegetation surveys. Both a topographic map and low level aerial photographs delineating any stressed terrestrial environments should be submitted. Vegetation survey data on species and abundance of macrofloral plants, usually trees and shrubs, should be collected. However, if the dominant habitat is an alpine or prairie environment, grasses and other plants should be examined. The community floral diversity can be calculated from the species information. Discussions of diversity should include species richness and community structure. This diversity information should be summarized in tabular form. Any differences between the background and affected habitats should be explained. The selection of the background habitat should be carefully planned so as to ensure that it is outside the influence of the facility. Sampling protocols for diversity and productivity studies along with the data collected and a complete discussion of results should be submitted by the applicant.

Endangered Species Impact Assessment

Endangered and threatened species near the facility should be identified. The facility owner or operator should contact the U.S. Department of the Interior, Fish and Wildlife Service, for a current list of endangered or threatened species in the vicinity of the facility. If any endangered or threatened species are in the area, then the potential impacts of the contaminated ground water on the species, including critical habitat impacts, should be discussed. A table should be submitted that lists the endangered and threatened species.

Aquatic Impact Assessment

The permit applicant should assess potential aquatic environmental effects by examining exposure factors. The exposure assessment for surface waters was discussed in Chapters VI and VII. Ground-water contaminants, flow direction, discharge areas, and proximity of surface waters are important considerations. The permit applicant should examine potential pathways of contaminant migration to surface waters. If exposure to contaminants is likely, then aquatic toxicity factors should be examined. The Office of Water, U.S. EPA, has published a document that the applicant and reviewer should find useful in evaluating aquatic impacts (U.S. EPA, 1985a). If no hazardous constituents can reach surface waters, then the permit applicant should provide supporting evidence of this fact. The aquatic impact assessment can be omitted if sufficient evidence is available to support a claim of no surface water exposure.

ACLs may be established based on contaminant discharge into a surface water body. This is allowable only where the contaminant plume has already reached the surface water body and the constituents do not cause a statistically significant increase in contaminant levels over background in the surface water concentrations. That is, after accounting for the inherent variation in the sampling and analysis data, the release of a constituent into a surface water body should not cause an increase in the background surface water concentration of that constituent.

In order to make this determination of statistical significance, samples of surface water should be taken during a period in which the flow (for rivers and

streams) or standing volume (for ponds and lakes) of the water body is near average conditions for the specific season. It may also be necessary to collect sediment samples to make this determination. The permit applicant should determine the flow of the surface water at or near the time of sampling and supply this determination, the actual monitoring data, and historical information that demonstrates that the flow at the time of sampling was near the seasonal average.

Surface water samples should be collected within the discharge zone of the ground- water contaminant plume. The discharge zone will have to be determined on a site-specific basis, and is dependent on the local hydrogeology. Since ground-water movement near surface water bodies can be quite complex, some of the initial samples may have to be collected adjacent to the facility as well as some distance downstream in order to identify the discharge zone. If, upon sampling in the discharge zone, the levels of the constituent of concern are not detectable, a statistical comparison of sampling data does not need to be performed. However, if the discharge levels are detectable, an appropriate statistical procedure should be used to compare the constituent concentration in the discharge zone to the constituent concentration upstream in the surface water body. The Agency expects to develop further guidance on appropriate statistical techniques for making these comparisons. The background concentration should be determined by sampling the surface water body in an area that is not expected to be affected by the RCRA facility, and is also not near other sources of contamination.

If a RCRA facility receives an ACL based upon the release of a contaminant into a surface water body, the facility's permit should contain a requirement for periodic surface water sampling. The sampling frequency should be determined on a site-specific basis to assure that the constituent concentration does not surpass a statistically significant level over background in that surface water body.

If it is found that the ground-water contamination discharge is not causing a statistically significant increase over background in the surface water body, then an ACL for an operating unit may be set at the contaminant levels currently at the point of compliance. However, if the ground-water contaminant plume contains much higher levels of contamination (i.e., hot spots) than have already reached the surface water, these hot spots may have to undergo some form of corrective action, so as to not violate the standard of statistical significance. To meet this standard,

appropriate ground-water contaminant plume management techniques will have to be selected on a site-specific basis.

Agricultural Impact Assessment

The potential impacts of ground-water contamination on agriculture should be examined when the POE is not set at the POC. Exposure pathways, crop impacts, and livestock impacts should be included in the assessment. The exposure assessment is used to determine if there are likely pathways for ground-water contaminants to reach any agricultural lands or products. As part of the exposure assessment, data on the agricultural land uses near the facility should be submitted by the permit applicant. Specific uses such as row crops, rangeland, grazing, tree farming, and timber should be depicted on an appropriately scaled map. A table that lists acreages of the specific uses should also be submitted.

The potential exposure pathways that the permit applicant should examine include shallow ground water, ground-water irrigation, and surface water irrigation. The shallow ground-water flow direction, aquifer attentuation mechanisms, and ground- water elevation are important characteristics that are used to determine exposure due to direct crop uptake of ground water. These topics were discussed in Chapters III and IV and must be evaluated by the permit applicant during this exposure assessment. The irrigation wells near the facility should be identified and delineated on a map employing the appropriate scale. Chapter VII lists specific use information that is necessary for this assessment of the irrigation wells. Surface waters that are used for irrigation and have the potential to be impacted by ground-water contamination must be evaluated (see Chapter VI). The current and projected irrigation withdrawal rates should be determined from each irrigation source.

Agricultural crop impacts should be assessed by the permit applicant if exposure to ACL constituents is likely to occur. The following potential agricultural impacts should be assessed:

1. Direct crop impacts and reduced productivity, and
2. Bioaccumulation of contaminants.

The permit applicant may be able to estimate the expected crop and productivity impacts resulting from exposure to hazardous contaminants in the ground water by examining the literature. Literature values that exist on crop impacts from exposure to the contaminants should be summarized in a table that includes the contaminant, the crop tested, the effect level, the bioaccumulation potential, and the specific reference. The U.S. Department of Agriculture (USDA) can be a source of crop effects information and testing methods. If literature information does not exist and crops are likely to be exposed to ACL constituents, the ACL demonstration may be denied and the ground-water standards may be set at background levels. However, the permit applicant has the opportunity to carry out experiments to estimate potential crop impacts. The applicant should be aware that standard experimental protocols do not exist and that all data to support the ACL demonstration must be submitted in a timely fashion. If tests are performed by the permit applicant, all protocols and data should be submitted.

The permit applicant should describe potential livestock impacts that may occur from direct and indirect exposure to contaminants found in the ground water. Direct exposure would include livestock contact through watering. Indirect exposure could include contact during animal grazing and foraging. The applicant should submit any available information on potential livestock impacts of the ACL contaminants. If literature values exist, the information should be summarized in tabular form and include the factors discussed above in the crop impacts section. The USDA may have information on this topic. Permit applicants are not normally expected to carry out experiments on exposed livestock because of the high costs and long-term nature of such experiments. If exposure modeling shows that livestock exposure occurs and sufficient literature information does not exist to support an ACL, then the concentration limit may be set at background levels.

Physical Structure Impact Assessment

Physical strucures can be adversely affected by hazardous constituents in the ground water. The situation at Love Canal, NY, where toxicants entered basements of homes, is just one example. The determination of potential damage to physical structures in the area around the facility requires the examination of exposure pathways, waste characteristics, environmental factors, and construction materials and techniques.

Determining the potential exposure of the physical structures to waste contaminants requires identification of physical structures in the area and exposure pathways. All manmade structures including buildings, buried cables and pipes, railroad beds, roads, parking areas, and machinery near the facility should be identified and delineated on a vicinity map if they are likely to be reached by contaminants. The possible exposure pathways of the ground-water contaminants to the physical structures should be identified. The permit applicant should refer to Chapter IV to determine what information should be submitted in order to determine contaminant migration pathways. If the exposure assessment determines that physical structures are likely to come in contact with ACL contaminants, then the potential effects of the contaminants on the physical structures should be examined. Otherwise, the permit applicant needs only to explain why the assessment is not needed.

The hazardous constituent characteristics of primary concern for the physical structure impact assessment are reactivity, ignitability, and migration potential. Two important categories of reactive chemicals are corrosives and solvents. The ground-water contaminants that fall into either of these two categories should be listed in a table by the permit applicant. The potential effects of these compounds on building materials such as concrete, iron, steel, plastic, wood, asphalt, and limerock should be identified and summarized in a table. The ability of the contaminants to permeate these materials should also be discussed. The permit applicant should submit data on the flammability and ignitability of the ACL constituents that have the potential to permeate subsurface structures. Volatile organic compounds should be given special attention since they have been implicated in sewer-line explosions.

CHAPTER XI

PERSISTENCE AND PERMANENCE OF POTENTIAL ADVERSE EFFECTS (40 CFR 264.94(b)(1)(ix) and (2)(x))

Many of the chapters in this guidance document discuss informational needs for ACL demonstrations that are related to the persistence and permanence of the ACL constituents. The general ACL policy will be to assume a worst case approach of no degradation of the ACL constituents, unless information on the persistence of the ACL constituents in the environment is submitted. Similarly, if a potential exists for exposure to the ACL constituents to result in adverse effects, the adverse effects will be considered permanent unless they are generally accepted to be not permanent or information is submitted by the permit applicant to justify that they are not permanent. This chapter describes the information that is needed to characterize the persistence of the ACL constituents in the environment and the permanence of their adverse effects if exposure occurs.

Persistence

Information on the persistence of the contaminants in the environment should be discussed in varying detail, depending on the basis of the ACL demonstration. The applicant should discuss the process by which each ACL constituent will degrade if the demonstration is attenuation-based. The processes should be discussed from a ground-water perspective, a surface water perspective, or any other environments or combination of environments depending on the site-specific situation. Contaminant degradation in ground water occurs predominantly through chemically mediated processes. If the applicant is claiming attenuation as a means of reducing the contaminant concentrations, the applicant must discuss the types of processes that may occur. These processes can include biodegradation, hydrolysis, photolysis, oxidation, reduction, adsorption, dispersion, or precipitation, all of which were discussed in Chapter II. The various degradation products, if known, should also be discussed.

If surface water exposure is involved, bioconcentration and biotransformation processes are important. Bioconcentration factors are important for evaluating human intake levels of contaminants from consumption of aquatic organisms and for assessing the permanence of ecological effects. Bioconcentration factors can be derived by experimentation or calculation or are provided in the literature. The applicant should provide justification for the use of any bioconcentration factors. Biotransformation is primarily carried out by microorganisms in the surrounding media. A lag time or acclimation period usually occurs before the biodegradation process begins. If biotransformation is used in the ACL demonstration, the applicant should determine whether the microbes are acclimated to the contaminant. A discussion of biotransformation and the use of bioconcentration factors can be found in U.S. EPA (1980) and U.S. EPA (1979).

If degradation processes are used in the ACL demonstration, the process rates should be calculated. Whether the mechanism of degradation is biological or chemical, all rates describing the processes should be included in the ACL demonstration. The parameters, coefficients, and assumptions used by the permit applicant to calculate the degradation rates for each contaminant should be submitted in tabular form.

Permanence

Information on the permanence of the adverse effects resulting from exposure to the ACL constituents will be required only if the ACL demonstration is based on attenuation mechanisms. This information should be included in the demonstration's health risk assessment (Chapter IX) and the environmental risk assessment (Chapter X). Permanence information is necessary in order to give the permit reviewer some idea of the long-term effects associated with exposure to each ACL constituent as well as a better understanding of which ground-water contaminants are of most concern.

Many environmental systems exhibit a high degree of resiliency. If the damage is limited to individual organisms within the population and the gene pool is not irreparably depleted, the environmental damage may be reversible. However, if irretrievable habitat change has occurred, then environmental damage may be permanent. The permit applicant should examine the literature on the

contaminant's environmental effects to determine the permanence of likely ecological impacts. Many biological evaluations can be performed to examine the resiliency and stability of an environmental system. Some examples include tissue analyses to determine bioaccumulation, diversity and recovery studies to estimate elasticity, and intolerant species analyses to determine the degree of degradation. A detailed explanation of these studies is presented in the Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses (U.S. EPA, 1983d). The permanence of the adverse effects is related to the contaminant's concentration level at the point of exposure. The acute and chronic effects levels for each contaminant should be determined if the ACL demonstration is based on attenuation considerations. The effects should be classified as either reversible or irreversible.

CHAPTER XII

SUMMARY AND CONCLUSIONS

The factors involved in preparing and supporting an ACL demonstration were discussed in the previous chapters. Chapter I outlined the Agency's policy quidelines for implementation of the ACL process. Information on each of the criteria discussed in this guidance document is not required in every ACL demonstration because every RCRA facility is unique with different environmental properties and waste characteristics. Therefore, each ACL demonstration based on attenuation mechanisms must reflect site-specific conditions. Much of the information required for an ACL demonstration may be taken from the facility's Part B permit application. This guidance document points out when additional information that satisfies the criteria should be submitted and also when it may not be necessary. However, the burden is always on the permit applicant to justify all arguments used for not submitting information on specific criteria. Appendix B contains a list of tables and figures that can be submitted as part of an ACL demonstration. The use of these tables and figures will greatly facilitate the review of the ACL demonstration by the permit writers. Appendix B also contains a summary outline of the information that can be used to support an ACL demonstration. The permit applicant should be sure to submit all data necessary to fulfill the information requirements outlined in this Appendix.

Once the data have been submitted by the permit applicant, the permit writer must assess the quality of the submitted information and determine the allowable concentrations of contaminants at the point of exposure, and the ACLs at the point of compliance. In many cases, the permit writer will have to use professional judgement in determining the adequacy of the submitted information.

The Agency will indicate its decision on the merits of the ACL demonstration when it issues the permit. The permit will contain a ground-water protection standard (GWPS) for each ground-water contaminant. The GWPS will contain either background values or the National Interim Primary Drinking Water Regulation limits listed in Table I of Section 264.94(a) (if EPA rejects the ACL demonstration), or

it will contain ACLs. If any constituent exceeds its ACL, corrective action will be necessary. The ACL then becomes the benchmark for the intensity and duration of the corrective action.

As part of the ground-water protection standard, an ACL is in effect during the compliance period. The compliance period is the number of years equal to the active life of the waste management area, including the closure period. If, at the end of the compliance period, the owner or operator is engaged in a corrective action program, the compliance period is extended until the owner or operator can demonstrate that the GWPS, which may contain ACLs, has not been exceeded for a period of three consecutive years.

Once the ground-water protection standard has been set in the permit, the permittee can only seek ACLs through permit modifications under the procedures outlined in 40 CFR Part 124. Such modifications are always major and the burden of proof to justify the variance is on the applicant. If a facility owner or operator violates the ground-water protection standards, he or she cannot postpone corrective action in order to argue for ACL changes.

CHAPTER XIII

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